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PARTS REQUIREMENTS AND COST MODEL (PARCOM) SENSITIVITY
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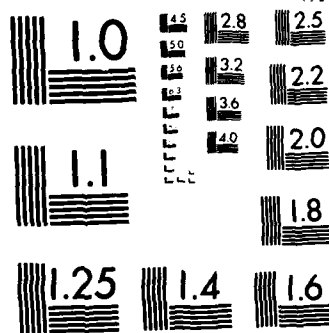
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USAAVSCOM
TECHNICAL MEMORANDUM TM 85-F-2

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**PARTS REQUIREMENTS AND COST MODEL (PARCOM)
SENSITIVITY ANALYSIS**

DAVID J. ALLTON
Operations Research Analyst

February 1985

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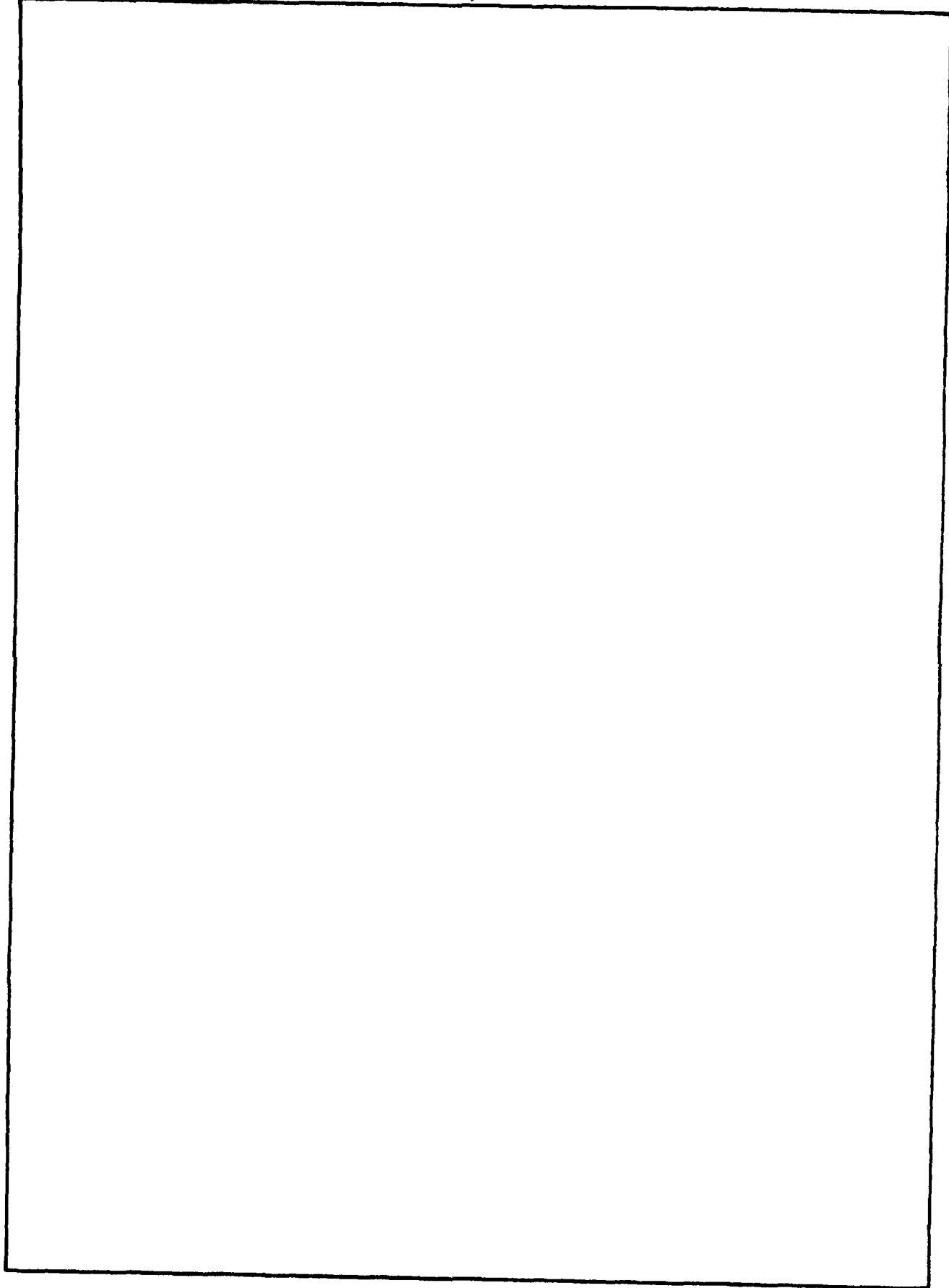
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PARTS REQUIREMENTS AND COST MODEL

(PARCOM)

SENSITIVITY ANALYSIS

**Dr. David J. Allton
Operations Research Analyst**

February 1985

**US ARMY AVIATION SYSTEMS COMMAND
DIRECTORATE FOR PLANS AND ANALYSIS
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Mr. David Allton, USAAVSCOM/AMSAV-BB

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1.0 INTRODUCTION

1.1 Overview/PARCOM Turnkey Project

In 1984, the Plans and Analysis Directorate of the US Army Aviation Systems Command (AVSCOM) obtained the Concepts Analysis Agency's (CAA's) versions of the Overview model and the Parts Requirement and Cost Model (PARCOM).

The Overview and PARCOM models were revised and developed as a result of the Aircraft Spare Stockage Methodology (Aircraft Spares) Study conducted by CAA. The main purpose of this study was to provide the Army with an analytical tool to provide a quickly gross estimation of spare parts requirements and costs as they relate to flying hour and availability objectives during a wartime scenario.

The Overview/PARCOM Turnkey Project resulted in an "extended PARCOM" to replace Overview. Therefore, PARCOM was considered to be a appropriate model to provide that quick reaction, gross estimation of spare parts requirements and costs as they relate to flying hour and availability objectives during a wartime scenario.

1.2 PARCOM Description

CAA developed PARCOM which generates cost-effective mixes of add-on aircraft spare parts need to achieve a specified flying program under:

- a. Various cost constraints
- b. Part replacement policies
- c. Aircraft availability objectives

PARCOM inputs consists of two data bases (parts data base and the scenario data base). The parts data base consists of several Reliability and Maintainability Logistics (RAMLOG) variables such as: unit cost; repair times; order and ship time; inventory; and failure rate per million flying hours. The scenario data base provides scenario type information such as: aircraft losses per day; maximum flying hours per aircraft per day; and add-on cost limit.

Typically, PARCOM outputs include total cost of various part replacement policies, daily aircraft availability and flying hours per aircraft per day, average aircraft availability and flying hours per aircraft per day, and fraction daily flying program achieved.

Typical questions addressed by PARCOM are, for example, using a budget limit of \$15 million:

- a. What spares should be added?
- b. What is associated fraction of flying program achievable?

1.3 Purpose of the Sensitivity Analysis

PARCOM is a deterministic model which means that all the parameters of the model are known constants. This implies that the variables entering the model can and are measured with a high degree of accuracy. Since these parameters are estimated from historical data, some uncertainty in their values is inevitably present. For this reason, a sensitivity analysis needs to be conducted on PARCOM. The general purpose of the sensitivity analysis is to determine which input variables are relatively sensitive (i.e., those variables that cannot be changed much without changing the solution). This will allow the analyst to know which variables need to be closely scrutinized in the data collection phase of any study that will use PARCOM.

2.0 STUDY METHODOLOGY

2.1 Choice of Variables

In this analysis, four input variables were chosen to determine their sensitivity to the output variable "percent of flying hours accomplished" for "current stock = initial stock, only cost of added buy (= 15,000,000.) is available for reallocation." This output variable is generally the last table in the output from a PARCOM computer run. The four input variables used are as follows:

- a. Failure Rate
- b. Inventory
- c. Maximum Flying Hours/Aircraft/Day
- d. Cost Constraint

The first two variables are from the parts data base and the last two are from the scenario data base. The failure rates for the baseline case were obtained from the Sample Data Collection (SDC). Since the data results from a sample with an assumption that errors found in the data would be randomly distributed (positives offset negatives) it would be useful to see the effect of non random errors to the data. Further, in discussions with the AH-1 Project Manager's Office, questions were raised as to the accuracy of the SDC and whether or not the Average Monthly Demand (AMD) factor should be used in lieu of SDC. Therefore, failure rates were chosen as an input for sensitivity analysis.

The current inventory for each part was generally obtained from estimates produced by SESAME. In discussions with various individuals at AVSCOM, it was determined that the actual inventory at a specific unit was extremely difficult to determine. Further, the Prescribed Load List (PLL) and the Authorized Stockage List (ASL) is different for each unit. Therefore any

inventory would be an estimation of what actually is the current inventory and very well may have a bias in the data.

In the Maximizing Daily Helicopter Flying Hours Study conducted by CAA, the issue of maximum flying hour/aircraft/day was addressed. This variable was chosen to determine the effect of changes in the maximum flying hours/aircraft/day on the percent of flying hours accomplished.

Since PARCOM was developed to consider the effect of changing budgeted dollar constraints to a flying hour program, one would expect that for the model to be useful the variable "cost constraint" should be sensitive.

2.2 Baseline Case Description

The baseline case represents that case in which the sensitivity analysis was based upon. The values for the inputs can be found in Appendices A and B. The resultant output value for the percent of flying hours accomplished was 53.2 percent. This represents the achievable program flying hours per available aircraft per day.

The baseline case represents those values for data collected for the AH-1S in the Overview/Turnkey Project with the exception that a cost constraint of \$15 million was used in lieu of \$10 million. Thus, the results of this sensitivity analysis provides a guide to the changes in the results for the AH-1S provided by this Command in the Overview/PARCOM Turnkey Project that may be experienced.

2.3 Procedure

The basic procedure used in this study was to change the value of the specified variable for all the parts by a specific amount. For example, the failure rates for all parts were increased by 10, 25, 50, and 75 percent and were also decreased by 10, 20 and 30 percent. This was done while holding all other variables at their baseline values. At no time was more than one variable changed from its baseline value. Further, for the variables failure rates and inventory, all parts were changed by the same increment.

Thus, the results for a change of the percent in the failure rates indicates the effect of changing all the failure rates by ten percent and then running PARCOM.

3.0 FINDINGS

3.1 Failure Rate

Figure 1 demonstrates that the output product called "Percent Flying Hours Accomplished" is highly sensitive to changes in the input variable "Failure Rate". If the "Failure Rate" is increased by 10%, then the "Percent Flying Hours Accomplished" is decreased from 53.2% to 44.9%, or a decrease of 15% from the baseline value. A decrease in failure rate of 10% results in a 25% increase in the output variable (from 53.2% to 67.2%).

This finding emphasizes the need for the analyst to scrutinize the data obtained that represents failure rate, very closely. This is because if the data does contain a bias one would expect a drastically different solution under unbiased conditions (i.e., if the SDC underestimates the failure rates the resulting flying hour program accomplishment is likely to be drastically over optimistic).

3.2 Inventory

Figure 2 shows the graphical results for changes in the input variable inventory. The model is sensitive to this parameter in an almost direct proportional representation. Thus, a 10 percent change in the baseline data variable produces an almost 10 percent change (of the baseline) in percent flying hours accomplished.

This finding shows the need for the analyst to fully state what inventory was used in the data base and how any estimates were made (i.e., were war reserves used as part of the initial inventory).

3.3 Maximum Flying Hours/Aircraft/Day

The findings for the variable "Maximum Flying Hours are shown on Figure 3. The findings indicate that the model is sensitive to the variable

Figure 1
"FAILURE RATE"

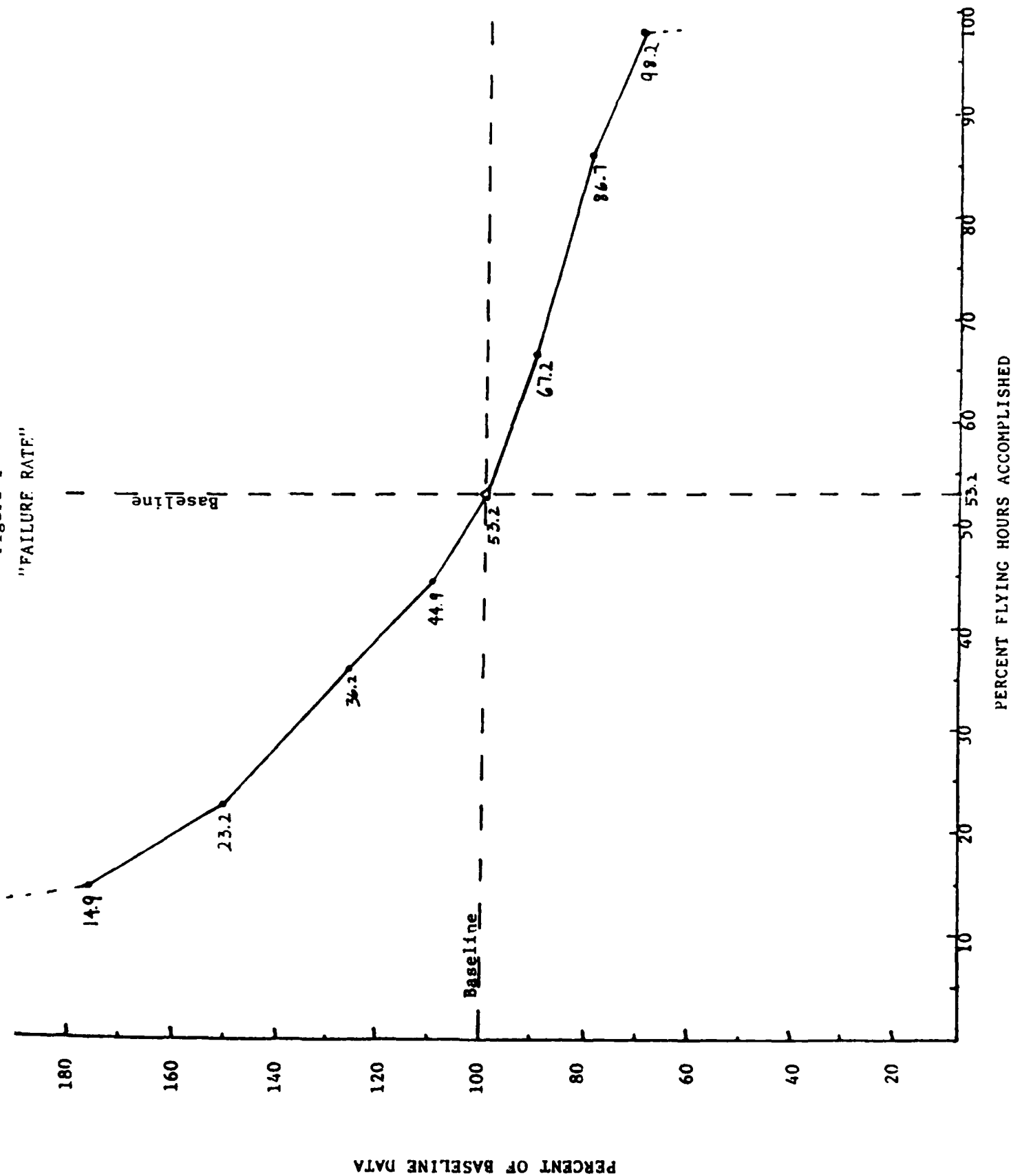


Figure 2
INVENTORY

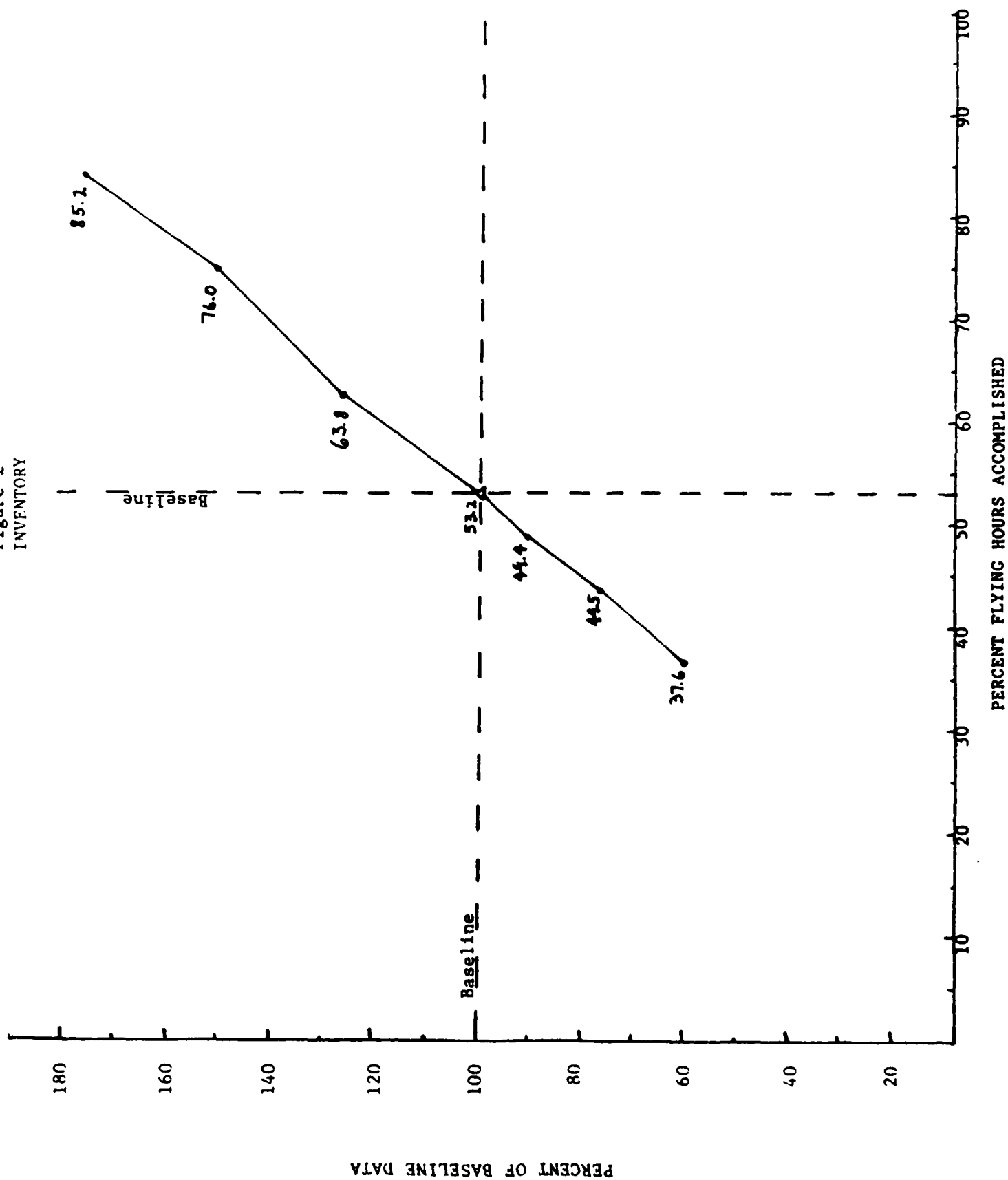
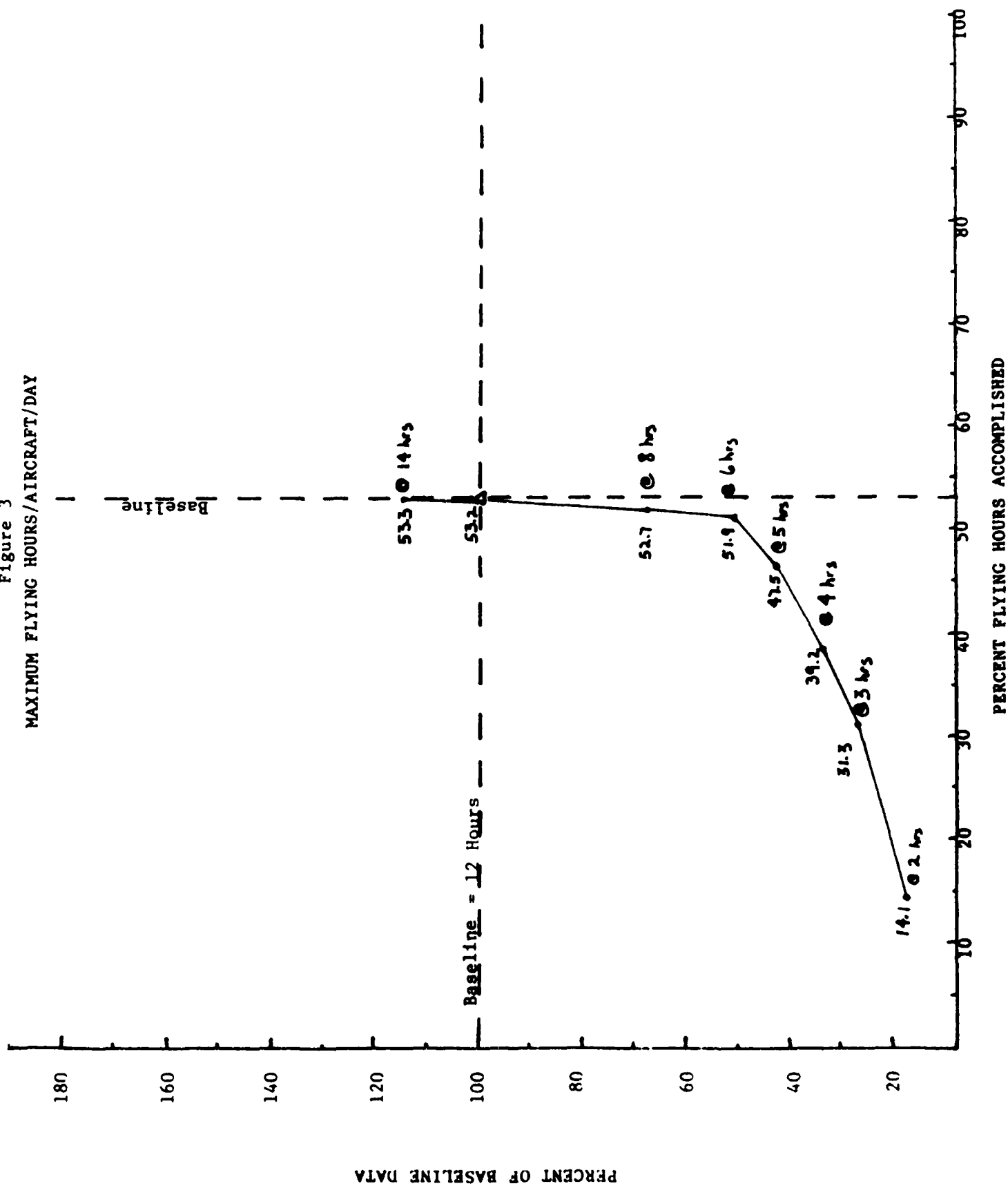


Figure 3
MAXIMUM FLYING HOURS/AIRCRAFT/DAY



in the low end of the spectrum. Once the maximum flying hours per day is set at 6 hours or more, there is virtually no change in the output. However, if one can only reasonably expect 2 to 6 hours of maximum fly hours per aircraft per day then the model is sensitive to the input and one can expect to find a much different solution, for example, for 4 hours as opposed to 5 hours.

3.4 Cost Constraint

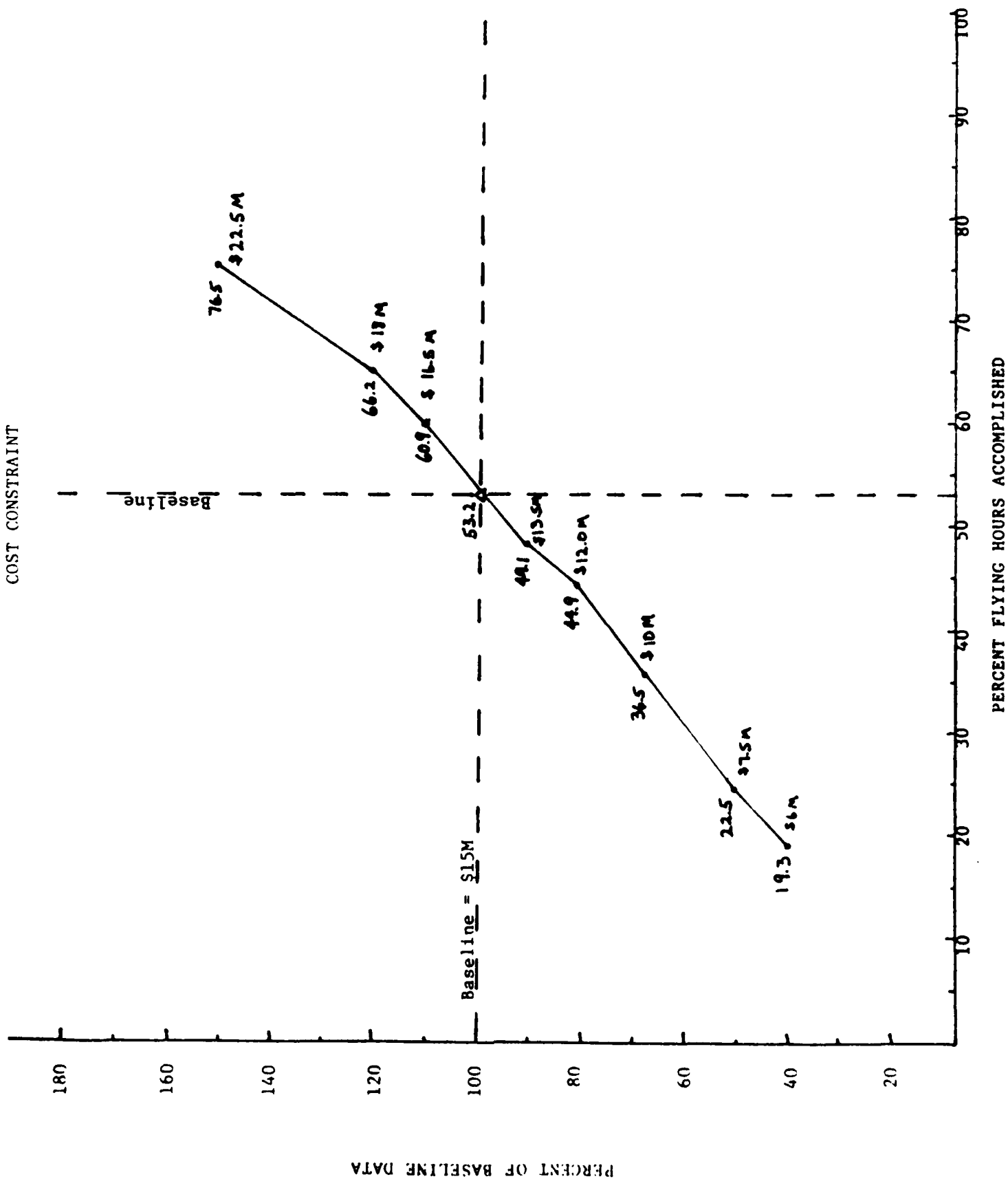
Since one of the purposes of PARCOM is to provide what are answers to various budget constraints, one would expect any model to show a sensitivity to this variable if cost is assumed to be a major driver of any flying hour program. Figure 4 demonstrates that changes in the add-on cost constraint will have an effect on the percent flying hours accomplished. Therefore, any decrease in the budget that would decrease the add-on cost constraint would significantly reduce the force capability of the fleet.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This analysis demonstrates the need for concern during the data collection phase of any study using PARCOM and the assurance that the various scenarios do reflect realistic assumptions and possibilities. Further, the need for annual updates (at least) is emphasized so that the data used is the most timely and hopefully most accurate. However, if a time trend is evident (i.e., the failure rates are getting higher every year) then special concern must be expressed as to even the gross accuracy of the results.

In order to help offset the problems highlighted in this study, it is recommended that any future PARCOM study (run) should contain a minor sensitivity analysis that shows what the effect would be if the failure rates were changed by plus or minus 10 percent and if inventory were changed by the same. This would produce a couple of ranges of the output variable "Percent Flying Hours Accomplished". It should be noted that PARCOM produces only rough estimates and these ranges should not be construed as anything other than ranges around rough estimates.

Figure 4
COST CONSTRAINT



APPENDIX A

Baseline Case Parts Data Base

APPENDIX A

BASELINE CASE PARTS DATA BASE

ITEMS RANK ORDERED IN NORMAL INPUT ORDER

PART	MSN	DESCRIPTION	COST	QST	FAIL	RT	NRTS	BCY	DCY	TRT	BCON	DCON	QPA	ESS	INVEN
1	1005003429007	FEEDER ASSY GUN	7601.	0.	0.000334	1.00	0.	0.	160.	90.	0.00	0.00	1.	1	20
2	1005007679002	GUN BARRELS	324.	0.	0.000003	0.00	0.	0.	70.	0.	1.00	0.00	3.	1	20
3	1055010709113	M260 ROCKET LAUN	600.	0.	0.000406	0.00	0.	0.	70.	0.	1.00	0.00	2.	1	20
4	1000105408070	GUN DRIVE MOTOR	4933.	0.	0.000125	1.00	0.	0.	100.	30.	0.00	0.10	1.	1	20
5	1000105408077	TURRET CNTRL ASSY	24417.	0.	0.000136	1.00	0.	0.	118.	48.	0.00	0.14	1.	1	20
6	100010562903	GUN CNTRL ASSEM	7501.	0.	0.000900	1.00	0.	0.	151.	81.	0.00	0.50	1.	1	20
7	1000106933363	LOGIC RELAY ASSY	5247.	0.	0.000316	1.00	0.	0.	190.	120.	0.00	0.02	1.	1	20
8	100010710715	GUN LOGIC CNTRL U	7885.	0.	0.000045	1.00	0.	0.	124.	54.	0.00	0.00	1.	1	20
9	100010719277	ELECT PROCES UNIT	29458.	0.	0.000013	1.00	0.	0.	370.	300.	0.00	0.05	1.	1	20
10	100010737284	AIRSP&DIRECT SEN	14916.	0.	0.000045	1.00	0.	0.	265.	195.	0.00	0.15	1.	1	20
11	100010743435	INERF CNTRL UNIT	7524.	0.	0.000181	1.00	0.	0.	286.	216.	0.00	0.02	1.	1	20
12	100010744313	LOW AIRSP INDICA	2491.	0.	0.000013	1.00	0.	0.	370.	300.	0.00	0.02	1.	1	20
13	100010778938	OPERATIONS UNIT	6490.	0.	0.000045	1.00	0.	0.	145.	75.	0.00	0.05	1.	1	20
14	100010778947	DISPLAY UNIT	11127.	0.	0.000226	1.00	0.	0.	172.	102.	0.00	0.00	1.	1	20
15	100010852594	EMERGENCY STOW CN	4437.	0.	0.000045	1.00	0.	0.	184.	114.	0.00	0.00	1.	1	20
16	100010869797	BUFFER AMP	864.	0.	0.000030	1.00	0.	0.	190.	120.	0.00	0.02	1.	1	20
17	100011004469	GUN TURRET	150000.	0.	0.000001	1.00	0.	0.	435.	365.	0.00	0.02	1.	1	20
18	10005734737	GUNNER LINKAGE A	2523.	0.	0.000226	1.00	0.	0.	370.	300.	0.00	0.00	1.	1	20
19	10005735209	PILOT LINKAGE AS	2466.	0.	0.000045	1.00	0.	0.	370.	300.	0.00	0.00	1.	1	20
20	10005780536	HELMET SIGHT AS	1656.	0.	0.000007	1.00	0.	0.	370.	300.	0.00	0.51	2.	1	20
21	10005780763	CABLE ASY	854.	0.	0.000002	1.00	0.	0.	370.	300.	0.00	0.00	1.	1	20
22	100103325123	ELEC INTERF ASY	10400.	0.	0.000136	1.00	0.	0.	370.	300.	0.00	0.00	1.	1	20
23	10010700490	SIGNAL PROCESSOR	41200.	0.	0.000497	1.00	0.	0.	229.	159.	0.00	0.02	1.	1	20
24	10010700495	FIRE CNTRL COMPUT	51704.	0.	0.000045	1.00	0.	0.	349.	279.	0.00	0.02	1.	1	20
25	10010700529	BORESIGHT MEMORY	6133.	0.	0.000000	1.00	0.	0.	307.	237.	0.00	0.02	1.	1	20
26	10010799378	HEADS-UP DISPLAY	45000.	0.	0.000407	1.00	0.	0.	238.	168.	0.00	0.02	1.	1	20
27	10006211508	TSU	170003.	0.	0.000632	1.00	0.	0.	84.	14.	0.00	0.01	1.	1	20
28	10006253730	MSL CMD AMPLIF	24235.	0.	0.000136	1.00	0.	0.	100.	30.	0.00	0.01	1.	1	20
29	10006253744	POWER SUPPLY	45351.	0.	0.000317	1.00	0.	0.	100.	30.	0.00	0.01	1.	1	20
30	10006253762	STAB CNTRL AMP	80592.	0.	0.000226	1.00	0.	0.	100.	30.	0.00	0.01	1.	1	20
31	10006268205	TOW LAUNCHER	12405.	0.	0.000045	1.00	0.	0.	100.	30.	0.00	0.01	2.	1	20
32	10006292605	SIGHT HAND CNTRL	2773.	0.	0.000045	1.00	0.	0.	100.	30.	0.00	0.01	1.	1	20
33	10010321311	TOW CNTRL PANEL	25298.	0.	0.000000	1.00	0.	0.	100.	30.	0.00	0.01	1.	1	20
34	100000899824	TUBE CYCLIC CONT	124.	0.	0.000044	0.00	0.	0.	90.	70.	0.	0.00	1.00	1.	20
35	10001761667	TRACK ASSEMBLY F	34.	0.	0.000271	0.00	0.	0.	84.	70.	0.	0.00	1.00	2.	80
36	10001796200	FAIRING ASSEMBLY F	5799.	0.	0.000045	0.62	0.	0.	42.	36.	0.00	0.00	1.00	1.	60
37	10003557911	PAC SWAY BRACE F	23.	0.	0.000066	0.00	0.	0.	75.	70.	0.	0.00	1.00	1.	60
38	10004200934	BOOT ASSEMBLY F	10.	0.	0.000045	0.00	0.	0.	66.	70.	0.	0.00	1.00	1.	20
39	10004454095	FUEL TANK AFT	3681.	0.	0.000030	0.40	0.	0.	30.	75.	0.	0.40	0.48	1.	20
40	10004464478	CONNECTING LINK	146.	0.	0.000030	0.00	0.	0.	90.	70.	0.	0.00	1.00	1.	20
41	10004536143	BELL CRANK	170.	0.	0.000045	0.00	0.	0.	90.	70.	0.	0.00	1.00	1.	20
42	10004843975	DUCT ASSY, OIL CO	174.	0.	0.000180	0.00	0.	0.	90.	70.	0.	0.00	1.00	1.	20
43	100049512117	PORT, RETAINING, C	7.	0.	0.000045	0.00	0.	0.	270.	70.	0.	0.00	1.00	1.	20
44	10007922324	PORT, DUST AND MC	60.	0.	0.000036	0.00	0.	0.	177.	70.	0.	0.00	1.00	1.	20
45	10008426011	PORT, CRANK	147.	0.	0.000045	0.00	0.	0.	201.	70.	0.	0.00	1.00	1.	20
46	10008727847	FAIRING ASSEMBLY	128.	0.	0.000497	0.00	0.	0.	156.	70.	0.	0.00	1.00	1.	20
47	10008770165	FAIRING ASSEMBLY A	68.	0.	0.000045	0.00	0.	0.	90.	70.	0.	0.00	1.00	1.	20
48	10008887348	FAIRING ASSEMBLY A	114.	0.	0.000045	0.00	0.	0.	141.	100.	0.	0.00	0.00	1.	14
49	10008989411	FAIRING ASSEMBLY A	470.	0.	0.000316	0.46	0.	0.	90.	95.	0.	0.54	0.00	1.	80
50	10009031018	*CNTRL, IDLER, FLY	530.	0.	0.000136	0.00	0.	0.	147.	100.	0.	0.00	0.00	1.	20

ITEMS RANK ORDERED IN NORMAL INVENTORY ORDER

PART	MSN	DESCRIPTION	COST	OST	FAIL	RT	MRTS	BCY	DCY	DRT	BCON	DCON	OPA	ESS	INVEN
51	1560009188099	LEVER, ELEVATOR, A	119.	0.0	0.000008	0.00	0.00	90.	70.	0.	0.00	1.00	2.	1	60
52	1560009275781	HORN ASSY ELEVAT	267.	0.0	0.000136	0.00	0.00	30.	70.	0.	0.40	0.00	1.	1	20
53	1560009716235	WALKING BEAM ASS	58.	0.0	0.000030	0.00	0.00	30.	70.	0.	0.05	0.00	1.	1	1
54	1560009716236	BELL CRANK	110.	0.0	0.000271	0.00	0.00	69.	70.	0.	0.00	0.00	1.	1	6
55	1560009716324	BELL CRANK	106.	0.0	0.000039	0.00	0.00	123.	100.	30.	0.00	0.99	1.	1	5
56	1560009731754	TANK, LUBRICATING	163.	0.0	0.000022	0.00	0.00	0.	75.	5.	0.00	0.00	1.	1	20
57	1560009902911	JACK SHAFT ASSEMB	403.	0.0	0.000045	0.00	0.00	90.	70.	0.	0.00	0.00	1.	1	2
58	1560010125788	LINK ASSEMBLY, LI	423.	0.0	0.000088	0.87	156.	100.	100.	30.	0.13	0.00	1.	1	80
59	1560010185919	FUEL TANK FWD	4154.	0.0	0.000030	0.50	30.	75.	75.	5.	0.00	0.48	1.	1	20
60	1560010258545	GUNNER DOOR PLEX	600.	0.0	0.000090	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	60
61	1560010258546	PILOT DOOR PLEXI	668.	0.0	0.000090	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	60
62	1560010268910	BELL CRANK	125.	0.0	0.000015	1.00	48.	70.	70.	0.	0.00	1.00	1.	1	2
63	1560010280472	TOP CANOPY PLEXI	877.	0.0	0.000136	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	2
64	1560010280474	PILOT WINDOW PLE	650.	0.0	0.000045	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
65	1560010280475	WINDSHLD LOW PLE	802.	0.0	0.000040	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	60
66	1560010280476	WINDSHLD UPP PLE	1037.	0.0	0.000271	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
67	1560010281090	BEAM ASSEMBLY, AN	112.	0.0	0.000015	0.00	24.	70.	70.	0.	0.00	1.00	1.	1	20
68	1560010685318	RECEIVER, REFUELI	940.	0.0	0.001672	0.00	153.	100.	100.	30.	0.00	0.00	1.	1	20
69	1560010710203	GUN WINDOW PLEX	1636.	0.0	0.000045	0.00	0.00	70.	70.	0.	1.00	0.00	1.	1	20
70	1560010927005	CLEVIS	10.	0.0	0.000542	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
71	1560011001938	GUN ARMOR UPP LH	1052.	0.0	0.000022	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
72	1560011001939	PILOT ARMOR U-RH	2106.	0.0	0.000020	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
73	1560011001963	GUN ARMOR UPP RH	1951.	0.0	0.000078	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
74	1560011002416	GUN SEAT BOT ARM	2935.	0.0	0.000030	0.00	0.00	0.	70.	0.	1.00	0.00	1.	1	20
75	1560011000429	PILOT LWR ARMOR	1129.	0.0	0.000015	0.00	15.	70.	70.	0.	0.70	0.00	1.	1	20
76	1560011181770	RACK, EXTERNAL ST	4137.	0.0	0.000045	0.67	207.	100.	100.	30.	0.33	0.00	1.	1	20
77	156000307199	RETAINER, MAIN RO	43.	0.0	0.000090	1.00	120.	70.	70.	0.	0.00	1.00	2.	1	20
78	156000336314	TRUNNION, MAIN RO	429.	0.0	0.000045	1.00	261.	100.	100.	30.	0.00	0.99	1.	1	20
79	156000548568	COLLET SET, ROTOR	233.	0.0	0.001085	1.00	162.	100.	100.	30.	0.00	1.00	1.	1	20
80	156000701130	DAMPER ASSEMBLY	1445.	0.0	0.001537	1.00	162.	100.	100.	30.	0.00	0.99	1.	1	20
81	156001685859	LINK ASSY, SNASH	188.	0.0	0.002215	1.00	336.	100.	100.	30.	0.00	0.99	2.	1	120
82	156001685863	SCISSORS AND SLE	1823.	0.0	0.000271	1.00	0.	83.	83.	13.	0.00	0.00	1.	1	100
83	156001724519	TRUNNION SET ASS	352.	0.0	0.000090	1.00	90.	70.	70.	0.	0.00	1.00	1.	1	60
84	156001724520	YOKE ASSEMBLY, TA	2389.	0.0	0.000542	1.00	141.	100.	100.	30.	0.00	0.99	1.	1	20
85	156001799165	MAST ASSY, TRANSM	6646.	0.0	0.000587	0.00	156.	111.	111.	41.	1.00	0.52	1.	1	60
86	156002542175	BLADE, ROTARY RU	2550.	0.0	0.001175	1.00	99.	70.	70.	0.	0.00	1.00	2.	1	80
87	156002542191	RETAINER, TAIL RO	35.	0.0	0.000045	1.00	90.	70.	70.	0.	0.00	1.00	1.	1	60
88	156003160610	HUB ASSEMBLY, TAI	2425.	0.0	0.000316	1.00	159.	100.	100.	30.	0.00	0.99	1.	1	60
89	156003467659	CROSSHEAD ASSEMB	980.	0.0	0.000090	1.00	90.	70.	70.	0.	0.00	1.00	1.	1	60
90	156003891958	BLADE, ROTARY WIN	7713.	0.0	0.001129	0.00	42.	110.	110.	40.	1.00	0.00	2.	1	160
91	156004105925	CHAFING STRIP, Y	0.	0.0	0.002305	0.00	147.	70.	70.	0.	0.00	1.00	4.	1	80
92	156004386344	DETECTOR, CHIP, TR	67.	0.0	0.000225	0.00	0.	70.	70.	0.	0.00	1.00	17.	1	120
93	156004422513	SCISSORS ASSY, SW	791.	0.0	0.000066	0.00	90.	100.	100.	30.	0.00	0.00	2.	1	20
94	156004776304	CHIP DETECTOR, TR	42.	0.0	0.000451	0.00	141.	100.	100.	30.	0.00	0.00	1.	1	80
95	156004821058	EXTENSION, PYLON	438.	0.0	0.000090	0.00	150.	70.	70.	0.	0.00	1.00	1.	1	60
96	156006250038	CONE SET, TRUNNIO	12.	0.0	0.000045	1.00	183.	70.	70.	0.	0.00	1.00	1.	1	60
97	156006907280	CAP ASSEMBLY, TAI	8.	0.0	0.000045	1.00	264.	100.	100.	30.	0.00	0.00	1.	1	80
98	156007010142	CORPUSING DRIVESH	208.	0.0	0.000225	0.97	87.	100.	100.	30.	0.03	0.00	1.	1	120
99	156007019935	CAP ASSEMBLY	5.	0.0	0.000045	0.00	81.	70.	70.	0.	0.00	1.00	1.	1	80
100	156007612531	CORPUSING SET	253.	0.0	0.000090	0.00	159.	70.	70.	0.	0.00	1.00	2.	1	20

ITEMS RANK ORDERED IN NORMAL INPUT ORDER

PART	MSN	DESCRIPTION	COST	QST	FAIL	RT	NRTS	BCY	DCY	DRT	BCON	DCON	QPA	ESS	INVEN
201	1840005709811	SEAL, TUBING, ENG	2.	0.	0.	0.000090	0.00	0.	70.	0.	1.30	0.00	1.	1	20
202	1840005711860	ENGINE, AIRCRAFT,	560550.	0.	0.	0.000116	0.15	180.	116.	46.	0.85	0.00	1.	1	100
203	184000568523	HOUSING, SEAL	25.	0.	0.	0.00022	0.00	0.	70.	0.	1.00	0.00	1.	1	20
204	1840007274663	ACC DRIVE GEARBO	6486.	0.	0.	0.00022	0.00	0.	100.	30.	0.00	0.02	1.	1	20
205	184000766845	LOCK RING	8.	0.	0.	0.00022	0.00	0.	70.	0.	1.00	0.00	1.	1	20
206	1840007821771	VALVE, LINEAR	318.	0.	0.	0.00044	0.25	10.	100.	30.	0.00	0.05	1.	1	20
207	1840009252973	TUBE ASSY INLET B	10.	0.	0.	0.00045	0.00	0.	70.	0.	1.00	0.00	1.	1	20
208	1840009259621	VANE ASSY COMPRES	228.	0.	0.	0.00030	0.00	0.	70.	0.	1.00	0.00	1.	1	20
209	1840009259644	VANE ASSY	228.	0.	0.	0.00030	0.00	0.	70.	0.	1.00	0.00	1.	1	20
210	1840009259747	CUP, LOCK PWR TUR	12.	0.	0.	0.00045	0.00	0.	70.	0.	1.00	0.00	1.	1	20
211	1840009432382	NOZZLE, TURBINE	2158.	0.	0.	0.00039	1.00	0.	104.	34.	0.00	0.00	1.	1	20
212	1840009455619	PLATE, LOCKING	0.	0.	0.	0.00045	0.00	0.	70.	0.	1.00	0.00	1.	1	20
213	1840009462416	VANE ASSEMBLY	216.	0.	0.	0.00022	0.00	0.	70.	0.	1.00	0.00	1.	1	20
214	1840009944302	HOUSING, ASSY F CN	16.	0.	0.	0.000136	0.00	0.	70.	0.	1.00	0.00	1.	1	20
215	1840010085730	CASE	2889.	0.	0.	0.00030	0.00	0.	100.	30.	0.00	0.02	1.	1	20
216	1910008039525	FILTER ELEMENT, F	3.	0.	0.	0.001084	0.00	90.	70.	0.	0.00	1.00	1.	1	80
217	1915000035903	VALVE, FUEL, MANIF	161.	0.	0.	0.000136	0.00	114.	100.	30.	0.00	0.00	1.	1	20
218	1915000035904	FILTER, FLUID	311.	0.	0.	0.000497	0.00	159.	100.	30.	0.00	0.00	1.	1	20
219	1915000180012	FUEL PUMP	271.	0.	0.	0.00093	0.00	0.	75.	5.	0.00	0.00	2.	1	20
220	19150007823819	NOZZLE, FUEL	93.	0.	0.	0.00039	0.00	0.	70.	0.	1.00	0.00	4.	1	20
221	19150009243560	VALVE, FUEL DRAIN	53.	0.	0.	0.00045	0.00	0.	70.	0.	1.00	0.00	1.	1	20
222	1915010059196	GOVERNOR	6323.	0.	0.	0.00226	1.00	0.	100.	30.	0.00	0.02	1.	1	20
223	1915010059197	FUEL CNTL	32421.	0.	0.	0.000316	1.00	0.	100.	30.	0.00	0.02	1.	1	20
224	1925008681795	WIRING HARNESS	267.	0.	0.	0.00045	0.00	0.	70.	0.	1.00	0.00	1.	1	20
225	1925009579947	IGNITER FLUG	16.	0.	0.	0.000226	0.00	0.	70.	0.	1.00	0.00	4.	1	20
226	1935001778331	COOLER, LUBRICATI	1319.	0.	0.	0.00045	0.00	204.	110.	40.	1.00	0.50	1.	1	100
227	1935005437296	TURBINE FAN, ENGI	1986.	0.	0.	0.000271	0.44	162.	100.	30.	0.56	0.00	2.	1	80
228	1935008086742	DUCT, OIL COOLER	374.	0.	0.	0.000316	0.00	120.	100.	30.	0.00	0.00	1.	1	20
229	1935008218752	VALVE, THERMOSTAT	100.	0.	0.	0.00090	0.00	96.	90.	20.	0.00	1.00	1.	1	60
230	1935008771113	COOLER, FLUID, TRA	271.	0.	0.	0.000136	0.50	75.	94.	24.	0.50	0.53	1.	1	20
231	1945000190280	FUEL AND OIL KIT	5.	0.	0.	0.000542	0.00	198.	70.	0.	0.00	1.00	1.	1	20
232	1945004422539	AIR FILTER ASSY,	3206.	0.	0.	0.00009	0.00	189.	100.	30.	0.00	0.10	1.	1	80
233	1945004422544	AIR FILTER ASSEM	2292.	0.	0.	0.00045	0.80	192.	94.	24.	0.20	0.25	1.	1	20
234	1945004422555	CLEANER, AIR, SAND	438.	0.	0.	0.000180	0.00	279.	100.	30.	0.00	0.00	1.	1	80
235	1995001104361	SCREEN, PARTICLE S	283.	0.	0.	0.00045	0.00	132.	100.	30.	0.00	0.00	1.	1	20
236	1995001104364	SCREEN, PARTICLE	199.	0.	0.	0.00045	0.00	141.	70.	0.	0.00	1.00	1.	1	20
237	1995008778054	LEVER AND BEARING	196.	0.	0.	0.00090	0.00	90.	70.	0.	0.00	1.00	1.	1	20
238	1995009273549	SHIELD ASSEMBLY	151.	0.	0.	0.00045	0.00	213.	70.	0.	0.00	1.00	1.	1	56
239	1995009273549	CAMBOX ASSY, DR30	135.	0.	0.	0.00090	0.00	237.	100.	30.	0.00	0.00	1.	1	20
240	1995009273549	IGNITION UNIT	473.	0.	0.	0.00030	0.00	0.	70.	0.	1.00	0.00	1.	1	20
241	3010006177707	COUPLING, SHAFT, R	44.	0.	0.	0.00015	0.00	120.	70.	0.	0.00	1.00	2.	1	60
242	3010009575846	CLAMP, COUPLING	30.	0.	0.	0.00042	0.00	165.	100.	30.	0.00	1.00	10.	1	80
243	3040001234638	CONNECTING LINK	108.	0.	0.	0.00022	0.00	180.	70.	0.	0.00	1.00	1.	1	20
244	3040001039495	CONNECTING LINK	213.	0.	0.	0.00020	0.00	90.	70.	0.	0.00	1.00	1.	1	20
245	3040001230560	CONNECTING LINK	4.	0.	0.	0.00090	0.00	90.	70.	0.	0.00	1.00	2.	1	20
246	3040004106334	CONNECTING LINK	125.	0.	0.	0.00022	0.00	114.	70.	0.	0.00	1.00	1.	1	60
247	3040004464436	CONNECTING LINK	251.	0.	0.	0.00044	0.00	162.	70.	0.	0.00	1.00	1.	1	20
248	3040008770102	CONNECTING LINK	195.	0.	0.	0.00044	0.00	90.	70.	0.	0.00	1.00	1.	1	1
249	3040008776573	CONNECTING LINK	178.	0.	0.	0.00045	0.00	285.	70.	0.	0.00	1.00	1.	1	49
250	3040008784915	CONNECTING LINK	189.	0.	0.	0.00008	0.00	90.	70.	0.	0.00	1.00	1.	1	20

ITEMS SHOWN ARE IN NORMAL INVENTORY ORDER

QTY	NO	DESCRIPTION	COST	QST	FAIL	RT	NRTS	BCY	DOY	DRT	BEON	UCON	UPA	ESS	INVEN
151	3040009318273	CONNECTING LINK	358.	0.0	0.000030	0.00	90.	70.	0.	0.00	0.00	1.	1.	1	21
152	3040009318274	CONNECTING LINK	252.	0.0	0.000196	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	49
153	3040009318275	CONNECTING LINK	127.	0.0	0.000045	0.00	177.	70.	0.	0.00	1.00	1.	1.	1	49
154	3040009318276	CONNECTING LINK	120.	0.0	0.000010	0.00	90.	70.	0.	0.00	0.00	1.	1.	1	20
155	3040009318279	CONNECTING LINK	114.	0.0	0.000022	0.00	177.	70.	0.	0.00	1.00	1.	1.	1	21
156	3040009318281	CONNECTING LINK	92.	0.0	0.000039	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	49
157	3040009318282	CONNECTING LINK	173.	0.0	0.000030	0.00	90.	70.	0.	0.00	0.00	1.	1.	1	21
158	3040009318286	CONNECTING LINK	181.	0.0	0.000030	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	20
159	3040009318288	CONNECTING LINK	73.	0.0	0.000030	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	49
160	3040009318289	CONNECTING LINK	179.	0.0	0.000030	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	49
161	3040009318290	CONNECTING LINK	122.	0.0	0.000030	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	21
162	3040009318291	CONNECTING LINK	144.	0.0	0.000123	0.00	270.	70.	0.	0.00	1.00	1.	1.	1	21
163	3040009318292	CONNECTING LINK	136.	0.0	0.000002	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	21
164	3040009318304	CONNECTING LINK	141.	0.0	0.000039	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	21
165	3040009321190	CONNECTING LINK	151.	0.0	0.000059	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	1
166	3040009321194	CONNECTING LINK	126.	0.0	0.000044	0.00	123.	70.	0.	0.00	0.00	1.	1.	1	1
167	3040009716232	CONNECTING LINK	81.	0.0	0.000002	0.00	309.	70.	0.	0.00	0.00	1.	1.	1	80
168	3040009716295	CONNECTING LINK	146.	0.0	0.000088	0.00	90.	70.	0.	0.00	1.00	2.	1.	1	20
169	3040009772663	CONNECTING LINK	137.	0.0	0.000039	0.00	90.	70.	0.	0.00	1.00	1.	1.	1	21
170	3040010290016	ROD	263.	0.0	0.000022	0.00	0.	70.	0.	0.00	0.00	1.	1.	1	2
171	3040010311200	TUBE ASY TR ONTL	276.	0.0	0.000010	0.00	15.	70.	0.	0.50	0.00	1.	1.	1	20
172	310005244569	BEARING, UNIVERSA	320.	0.0	0.000181	1.00	162.	70.	0.	0.00	1.00	2.	1.	1	20
173	310007273032	BEARING, BALL, ANN	146.	0.0	0.000045	1.00	0.	100.	30.	0.00	0.02	2.	1.	1	20
174	310010158831	BEARING ROLLER	289.	0.0	0.000045	0.00	0.	70.	0.	1.00	0.00	3.	1.	1	20
175	310010304306	BEARING, BALL, ANN	40.	0.0	0.000286	1.00	396.	70.	0.	0.00	1.00	1.	1.	1	20
176	31004055164	BEARING, SLEEVE	21.	0.0	0.000045	1.00	90.	70.	0.	0.00	1.00	1.	1.	1	20
177	310007715927	BUSHING, SLEEVE	7.	0.0	0.000181	1.00	223.	70.	0.	0.00	1.00	2.	1.	1	21
178	310007715938	BUSHING, SLEEVE	20.	0.0	0.000242	1.00	207.	70.	0.	0.00	1.00	2.	1.	1	20
179	310007726188	BEARING, SLEEVE	14.	0.0	0.000008	1.00	171.	70.	0.	0.00	1.00	4.	1.	1	20
180	310008973758	BEARING, ROD END	7.	0.0	0.000004	1.00	102.	90.	20.	0.00	1.00	1.	1.	1	100
181	310009049829	BEARING, INLET GD	5.	0.0	0.000020	0.00	0.	70.	0.	1.00	0.00	2.	1.	1	20
182	310009415557	BEARING, PLAIN, RO	15.	0.0	0.000007	0.00	90.	70.	0.	0.00	1.00	3.	1.	1	100
183	310009764495	BEARING, SLEEVE	82.	0.0	0.000633	0.00	162.	70.	0.	0.00	1.00	2.	1.	1	20
184	310009820804	BEARING, SLEEVE	93.	0.0	0.000633	0.00	147.	70.	0.	0.00	1.00	2.	1.	1	40
185	310010030120	BEARING, PLAIN, RO	177.	0.0	0.002621	0.00	216.	70.	0.	0.00	1.00	2.	1.	1	80
186	310009345653	BEARING, PLAIN, RO	43.	0.0	0.000045	0.00	165.	70.	0.	0.00	1.00	1.	1.	1	80
187	310010304307	BEARING, PLAIN, RO	231.	0.0	0.000136	0.00	102.	70.	0.	0.00	1.00	2.	1.	1	20
188	31001171868	BEARING UNIT, PLA	648.	0.0	0.000181	1.00	162.	70.	0.	0.00	1.00	2.	1.	1	20
189	310009305274	BEARING UNIT, ROL	25.	0.0	0.000045	1.00	81.	100.	30.	0.00	0.00	2.	1.	1	19
190	310009971611	WIRE ROPE ASSEMB	13.	0.0	0.000723	1.00	102.	70.	0.	0.00	1.00	2.	1.	1	20
191	310009971611	WIRE ROPE ASSEMB	597.	0.0	0.000001	0.26	207.	100.	30.	0.74	0.00	2.	1.	1	20
192	310009971611	WIRE ROPE ASSEMB	803.	0.0	0.000197	3.00	0.	100.	30.	0.00	0.01	2.	1.	1	20
193	310009971611	WIRE ROPE ASSEMB	185.	0.0	0.000045	1.00	0.	100.	30.	0.00	0.02	1.	1.	1	20
194	310009971611	WIRE ROPE ASSEMB	5417.	0.0	0.000542	1.00	0.	100.	30.	0.00	0.00	1.	1.	1	80
195	310009971611	WIRE ROPE ASSEMB	8.	0.0	0.001310	1.00	180.	70.	0.	0.00	1.00	1.	1.	1	180
196	310009971611	WIRE ROPE ASSEMB	1108.	0.0	0.000180	0.54	90.	110.	40.	0.45	0.00	1.	1.	1	20
197	310009971611	WIRE ROPE ASSEMB	635.	0.0	0.004429	0.00	51.	100.	30.	0.00	0.00	2.	1.	1	20
198	31000665271	WIRE ROPE ASSEMB	44.	0.0	0.000090	0.00	189.	70.	0.	0.00	1.00	1.	1.	1	20
199	31000665271	WIRE ROPE ASSEMB	15.	0.0	0.000045	0.00	0.	70.	0.	0.10	0.00	1.	1.	1	20
200	31001554714	WIRE ROPE ASSEMB	75.	0.0	0.000022	0.00	45.	70.	0.	0.00	1.00	1.	1.	1	20

ITEMS RUN AGENTS IN NORMAL INPUT ORDER

PART	MSN	DESCRIPTION	COST	OST	FAIL	RT	NRTS	BCY	DCY	DRT	BCON	DCON	QPA	ESS	INVEN
301	4720001819173	HOSE ASSEMBLY, NO	77.	2.2.	0.00045	0.00	168.	70.	70.	0.	0.00	1.00	1.	1	100
302	4720001819180	HOSE ASSEMBLY, NO	1613.	0.0.	0.00003	0.00	135.	70.	70.	0.	0.00	1.00	1.	1	100
303	4720001819286	HOSE ASSEMBLY, NO	25.	0.0.	0.00022	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	100
304	4720001819313	HOSE ASSEMBLY, NO	26.	0.0.	0.00046	0.00	111.	70.	70.	0.	0.00	1.00	1.	1	100
305	4720001819318	HOSE ASSEMBLY, NO	18.	0.0.	0.00090	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	100
306	4720001826229	HOSE ASSEMBLY, NO	29.	0.0.	0.00078	0.00	45.	70.	70.	0.	0.00	1.00	1.	1	60
307	472000182852	HOSE, AIR DUCT	11.	0.0.	0.00058	0.00	45.	70.	70.	0.	0.00	1.00	4.	1	60
308	4720001831352	HOSE ASSEMBLY, NO	26.	0.0.	0.00018	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	20
309	4720001838308	HOSE ASSY	5.	0.0.	0.00045	0.00	0.	70.	70.	0.	1.00	0.00	1.	1	20
310	4730001815144	COUPLING HALF, SP	147.	0.0.	0.00045	0.00	51.	70.	70.	0.	0.00	1.00	2.	1	20
311	4730001839770	COUPLING MALE, SP	432.	0.0.	0.00045	0.00	33.	70.	70.	0.	0.00	1.00	4.	1	120
312	4730001884533	FITTING, LUBRICAN	26.	0.0.	0.00090	0.00	84.	100.	100.	30.	0.00	0.00	1.	1	60
313	4810001815670	VALVE, SOLENOID	579.	0.0.	0.00045	0.00	0.	77.	77.	7.	0.00	0.01	1.	1	20
314	481000187692	VALVE, SOLENOID	68.	0.0.	0.00045	0.00	0.	70.	70.	0.	1.00	0.00	1.	1	20
315	48100018782845	VALVE, CUTOFF	227.	0.0.	0.00045	0.00	147.	100.	100.	30.	0.35	0.00	1.	1	20
316	48100018785102	VALVE, SOLENOID	120.	0.0.	0.00078	0.00	135.	70.	70.	0.	0.00	1.00	1.	1	14
317	4810001812299	VALVE, LINEAR, DIR	295.	0.0.	0.00090	0.00	90.	70.	70.	0.	0.00	1.00	3.	1	60
318	48100018780880	HYD SOL VALVE	219.	0.0.	0.00090	0.00	10.	70.	70.	0.	0.20	0.00	3.	1	80
319	4820001814720	VALVE, AIR PRESSU	21.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	20
320	4820001819230	COCK, POPPET DRAI	30.	0.0.	0.00181	0.00	189.	70.	70.	0.	0.00	1.00	1.	1	80
321	4820001819247	COCK, POPPET DRAI	68.	0.0.	0.00136	0.00	66.	70.	70.	0.	0.00	1.00	1.	1	80
322	4820001849613	VALVE, SELF CLOSI	48.	0.0.	0.00045	0.00	57.	70.	70.	0.	0.00	1.00	1.	1	80
323	48200018730625	VALVE, CHECK	35.	0.0.	0.00045	0.00	75.	70.	70.	0.	0.00	1.00	4.	1	60
324	4820001875273	VALVE, CHECK	55.	0.0.	0.00020	0.00	141.	70.	70.	0.	0.00	1.00	6.	1	80
325	53060018756790	BOLT, SHEAR	9.	0.0.	0.00225	0.00	210.	70.	70.	0.	0.00	1.00	4.	1	20
326	53100018245116	NUT, PLAIN, SPLINE	691.	0.0.	0.00045	0.00	36.	70.	70.	0.	0.00	1.00	1.	1	20
327	53100018455750	WASHER KEY	0.	0.0.	0.00542	0.00	0.	70.	70.	0.	1.00	0.00	6.	1	20
328	53300018757503	PACKING, PREFORME	0.	0.0.	0.00090	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	20
329	53300018783882	GASKET	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	20
330	53300018795809	RING, WIPER	2.	0.0.	0.00045	0.00	0.	70.	70.	0.	0.00	1.00	1.	1	60
331	53300018791224	SEAL, PLAIN ENCAS	13.	0.0.	0.00181	0.00	171.	70.	70.	0.	0.00	1.00	1.	1	20
332	53300018995892	GASKET	0.	0.0.	0.00225	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	20
333	53300018995892	PACKING, PREFORME	0.	0.0.	0.00090	0.00	90.	70.	70.	0.	0.00	1.00	3.	1	100
334	53300018995892	PACKING, PREFORME	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	2.	1	120
335	53300018995892	GASKET	7.	0.0.	0.00135	0.00	99.	70.	70.	0.	0.00	1.00	2.	1	80
336	53300018995892	PACKING, PREFORME	0.	0.0.	0.00225	0.00	90.	70.	70.	0.	0.00	1.00	13.	1	500
337	53300018995892	PACKING, PREFORME	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	2.	1	120
338	53300018995892	PACKING, PREFORME	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	10.	1	460
339	53300018995892	PACKING, PREFORME	2.	0.0.	0.00180	0.00	0.	70.	70.	0.	0.00	1.00	3.	1	100
340	53300018995892	SEAL, PLAIN	1.	0.0.	0.00180	0.00	138.	70.	70.	0.	0.00	1.00	1.	1	360
341	53300018995892	PACKING, PREFORME	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	2.	1	80
342	53300018995892	SEAL	1.	0.0.	0.00022	0.00	0.	70.	70.	0.	1.00	0.00	1.	1	140
343	53300018995892	SEAL, PLAIN ENCAS	2.	0.0.	0.00058	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	180
344	53300018995892	PACKING, PREFORME	0.	0.0.	0.00225	0.00	90.	70.	70.	0.	0.00	1.00	6.	1	100
345	53300018995892	GASKET	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	2.	1	80
346	53300018995892	PACKING, PREFORME	1.	0.0.	0.00316	0.00	139.	70.	70.	0.	0.00	1.00	4.	1	80
347	53300018995892	PACKING, PREFORME	0.	0.0.	0.00045	0.00	90.	70.	70.	0.	0.00	1.00	1.	1	260
348	53300018995892	SEAL CASE	0.	0.0.	0.00136	0.00	0.	70.	70.	0.	1.00	0.00	1.	1	20
349	53300018995892	PACKING, PREFORME	0.	0.0.	0.00045	0.00	0.	70.	70.	0.	0.00	1.00	1.	1	80

ITEMS RANK ORDERED IN NORMAL INQUIRY ORDER

PART	QTY	DESCRIPTION	QTY	RT	NR	BCY	UCY	DRT	BCON	DCON	OPA	ESS	INVEN
401	1	3IN MOTION XROCE	97.	0.0.000010	0.00	0.	70.	0.	1.00	0.00	1.	1	20
402	1	GLASS LIQUID 316	3.	0.0.000225	1.00	0.	70.	0.	0.00	1.00	1.	1	80
403	1	GLASS LIQUID 316	2.	0.0.000853	1.00	90.	70.	0.	0.00	1.00	1.	1	100
404	1	INDICAT FUEL P/L	1236.	0.0.000678	1.00	0.	100.	30.	0.00	0.00	1.	1	20
405	1	TRANSMITTER ICHP	36.	0.0.000497	1.00	90.	70.	0.	0.00	1.00	1.	1	60
406	1	INDIC ENG OIL P/L	610.	0.0.000271	1.00	0.	75.	5.	0.00	0.00	1.	1	80

TOTAL NR PARTS = 406 NR USED = 406

APPENDIX B

Baseline Case Scenario Data Base

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3. Hillier, F. S., and G. J. Lieberman, Operations Research (2nd Edition), San Francisco, California: Holden-Day, Inc., 1974.
4. Penn, S. L., et al., Aircraft Spare Stockage Methodology (Aircraft Spares) Study, CAA-SR-84-12, Bethesda, Maryland: US Army Concepts Analysis Agency, April 1984 (Unclassified).
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